REMARKS

This application has been amended. Specifically, claims 16-23 have been added. Support for claims 16-19 can be found, for example, on page 9 of the application as filed. Support for claims 20 and 21 can be found, for example, on pages 11 and 12 of the application as filed. Support for claims 22 and 23 can be found, for example, on page 28 of the application as filed. Thus, no new matter has been added. Claims 9-12 and 15, which were previously withdrawn as directed to a non-elected invention, have been canceled without prejudice to filing a divisional application directed to this subject matter. Accordingly, claims 1-8, 13-14 and 16-23 are pending, of which claims 1, 3, 7 and 8 are in independent form.

Claims 1-8, 13 and 14 stand rejected under 35 U.S.C. §112, second paragraph for indefiniteness. The Office Action sets forth three different phrases appearing in the claims which form the basis of this rejection. Each is discussed below. For the following reasons, this rejection is traversed.

First, the Office Action asserts that the claims refer to a "pre-treatment step" but fail to clarify what the pre-treatment step occurs before. For purposes of examination, the pre-treatment step was treated as occurring before the electroless plating. It has been requested that Applicants clarify what is intended. Applicants confirm that the Examiner's understanding as to the timing of the pre-treatment step is correct. The pre-treatment step is a separate step which precedes the electroless plating. It is believed this is clear from the specification. For example, page 7 describes a "swelling step" which is carried out as a "pre-treatment." On page 19, the Applicants then describe embodiments of the "Method for electroless plating" which includes, after completing the swelling step, subjecting the swollen polymer electrode to an adsorption step and a reduction step. As described in the last paragraph on page 12, the pre-treatment swelling can decrease the degree of crystallization in the polymer electrode and increase the degree of freedom of segmental motion of the side chains. In other words, the pre-treatment step can "reformulate" the polymer electrolyte and better prepare it for subsequent adsorption and reduction of a metal complex, performed during the electroless plating.

The Office Action also asserts that the phrase "good solvent" in claims 1 and 3 is indefinite. For purposes of examination, "good solvent" was interpreted as any solvent that

allows the claimed amount of swelling. Applicants confirm that this understanding is correct and consistent with the specification. For example, the second paragraph on page 11 reads "[t]he above-described good solvent means a solvent allowing a polymer to swell well, so that a good solvent is different depending on types of polymer constituting a polymer electrolyte." This paragraph then continues in describing various embodiments of the good solvent. Based on this language in the specification, and the consistent interpretation provided for the phrase "good solvent" thus far, Applicants submit that this phrase is sufficiently definite.

The Office Action also questions whether the "adsorption step" and "reduction step" are part of the "electroless plating" or if these are some other step. Applicants believe that the specification, and particularly that portion which begins on page 19 under the heading "method for electroless plating," confirms that these steps are part of the electroless plating. This is consistent with the way in which these steps were interpreted for purposes of examination.

Therefore, in view of the description provided in the specification, Applicants submit that the claims are sufficiently clear and precise to be understood by one skilled in the art having considering the patent as a whole. Thus, the rejection of claims 1-8, 13 and 14 under 35 U.S.C. §112, second paragraph for indefiniteness should be reconsidered and withdrawn.

Claims 1-5, 7, 8 and 13 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 4,959,132 to Fedkiw, Jr. in view of the admitted state of the prior art. Claims 6 and 14 stand rejected under 35 U.S.C. §103(a) for obviousness over Fedkiw in view of the admitted state of the art and further in view of U.S. Patent No. 5,024,858 to Burch. These rejections are respectfully traversed.

Claims 1 and 7 are directed to a method for electroless plating of a polymer electrolyte which includes a pre-treatment step in which the polymer electrolyte is swelled. In claim 1, the swelling is by permeation of a good solvent or mixed solvent containing a good solvent. In claim 7, the swelling is through permeation of an aqueous solution of a salt. Claims 3 and 8 are directed to a method for manufacturing a laminate, and the method includes a pre-treatment step in which the polymer electrolyte is swelled by permeation of a good solvent or mixed containing a good solvent (claim 3) or through permeation of an aqueous solution of a salt

(claim 8). In each instance, the swollen state of the polymer electrolyte is 110% or more of that of the polymer electrolyte in a dry state. Further, the swelling step of the claimed methods is consistently described as a pre-treatment step.

As explained in the specification, a laminate where the metal layer is formed on a polymer electrolyte which undergoes a pre-treatment swelling step before electroless plating has been observed to have a larger electrical capacity compared with a laminate formed from a polymer electrolyte which does not undergo the pre-treatment step. (Specification, page 11.) As a result of the swelling of the polymer in the pre-treatment stage, the degree of crystallization in the polymer decreases, the inter-twisting of side chains having functional groups is moderated, and the degree of freedom in the segmental motion with respect to the side chains increases. (Specification, page 12.) This pre-treatment step occurs before electroless plating of the polymer electrolyte through adsorption and reduction of a metal complex. Performing the pre-treatment swelling allows the metal complex and reductant to more easily permeate into the polymer electrode and a metal layer having a larger surface area can be formed. The pre-treatment swelling step is, so to speak, a "reformulation" of the polymer electrolyte performed prior to electroless plating.

Fedkiw is directed to a two-step process for preparing metallic electrocatalytic films embedded proximate to one or both of the surfaces of a solid polymer electrolyte membrane. (Fedkiw, 4:28-29.) The first step is an impregnation process in which a solid polymer electrolyte membrane is impregnated with an ionic salt or salts of the desired metal, ideally through the saturation of the membrane with a cationic metal salt solution. (Fedkiw, 4:29-38.) The second step of the two-step process is a reduction step in which an electrocatalytic film is formed on one face of the membrane. (Fedkiw, 4:50-52.) The reduction step causes a chemical reduction of the impregnated metallic cations to the metal(0) state and the formation of an electrocatalytic film proximate the membrane surface. (Fedkiw, 4:58-61.) Fedkiw does not teach or suggest a pre-treatment swelling step as defined in the claims.

The Office Action, while agreeing that Fedkiw does not teach a pre-treatment swelling step, asserts that it is well known to repeatedly immerse a polymer electrolyte in water to swell it, adsorb a metal complex such as a Pt complex, and reduce the metal complex with a

reducing agent. For support, the Office Action points to pages 2 and 3 of the present specification. The Office Action concludes that it would therefore be obvious to modify Fedkiw to perform multiple adsorption/reduction cycles with the first adsorption/reduction cycle constituting a "pre-treatment" for the latter adsorption/reduction cycle(s). As discussed above, Fedkiw is directed to a two-step, adsorption/reduction process. The Office Action thus appears to be concluding that if the two-step process of Fedkiw is repeated, the adsorption step in a first "cycle" would constitute a pre-treatment step for a second adsorption/reduction "cycle."

This is not a fair characterization of Fedkiw or the present invention. The hypothesized process in which the adsorption and reduction steps of Fedkiw are repeated would appear to be similar to the process employed in the Comparative Examples in the subject application. For instance, beginning on page 47, Applicants describe a process in which electroless plating was carried out by immersing a polymer electrolyte in an aqueous solution of dichlorophenanthroline gold(III)chloride for twelve hours to allow the gold(III) complex to adsorb into the polymer electrolyte. (Specification, page 48.) The absorbed gold complex is then reduced in an aqueous solution, and the film is washed with water. Each of the adsorption, reduction, and washing steps was repeated over six cycles. (Specification, page 47.)

However, as stated in the specification, this process does not include a pre-treatment swelling step despite the fact that the step of immersing the polymer electrolyte in an aqueous solution is repeated six times. (Specification, page 47.) This is because immersing the polymer electrolyte in the aqueous solution is not a "pre-treatment" but is rather the manner in which the gold(III) complex is adsorbed. While limitations from the specification are not to be read into the claims, the claims should still be read consistent with the specification. A consistent reading of the specification would indicate that the pre-treatment step is a step which occurs before adsorption of a metal complex into the polymer electrolyte. Moreover, Tables 1-4 of the subject application show that the degree of swelling achieved using a pre-treatment swelling step is greater than when the polymer electrolyte is simply repeatedly immersed in an aqueous gold(III)chloride solution during the electroless plating process, and laminates prepared using a pre-treatment step have improved electrical characteristics compared with those prepared according to the conventional process.

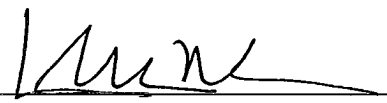
Applicants submit that the specification makes clear that a process including a pre-treatment swelling step is distinguishable from a process, like in the Comparative Examples or hypothesized in the Office Action, which does not include a swelling step performed as a pre-treatment in the electroless plating of the polymer electrolyte. Accordingly, Applicants respectfully submit that the pending claims are patentable over Fedkiw and the rejections based thereon should be reconsidered and withdrawn.

CONCLUSION

For the foregoing reasons, Applicants submit that the pending claims are patentable over the cited documents of record and are in condition for allowance. Accordingly, reconsideration of the outstanding rejections and allowance of pending claims 1-8, 13-14 and 16-23 is respectfully requested.

Respectfully submitted,

THE WEBB LAW FIRM

By 

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